NATIONAL SYMPOSIUM
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"IMPROVING CANAL IRRIGATION MANAGEMENT : NO NEED TO WAIT"

Special Lecture
by
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The Ford Foundation
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SPECIAL LECTURE

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Purpose

The purpose of this paper is to present feasible actions which irrigation managers can take now to improve performance on their systems. It has been inspired by two engineers, N.M. Joshi and S.N. Lele, who have demonstrated what can be done without waiting.

Definitions In this paper:

"appraisal" means "finding out" in a general sense. It is not to be confused with the World Bank's Technical meaning of the word to describe a stage in the project process.

"canal irrigation" refers to all irrigation through canals where government staff control water issues. In India this includes all major (>10,000 ha command) and medium (<10,000 ha but > 2,000 ha) canal irrigation.

"irrigation system" includes physical works (barrages, canals, control structures, field channels, fields, drains, telephones, etc.), people (irrigation staff, agriculture staff, irrigator households, labour households etc.), farming systems (including soils, crops, labour etc.) and water; and the rights, conventions, communications and interactions which link these.

"irrigation system manager" and 'canal manager' refers to a person responsible for water distribution on the main system.

"main system" includes reservoirs and river diversion works, and canals, distributaries and minor channels down to outlets which are the usual point of handover from irrigation management staff to farmers' group and farmers.

"management" refers to the management of people, of communications and controls, and of resources.

"performance" refers to maximising benefits, including productivity and equity, and minimising adverse environmental, social and health effects.

The views expressed in this paper are those of the author and do not necessarily reflect those of the Ford Foundation.

Potential and Priority

In many countries, by no means only India, improved management of existing canal irrigation systems is recognised as a high priority (CGIAR 1982). Some of the main reasons given are :

- the potential of well-managed irrigation systems for alleviating poverty through enabling small and marginal farmers to produce and earn more and reducing their risks and through raising the incomes of labourers through higher wages and more days worked
- recognition of irrigation as a major means for national economic development (food production, secondary employment, generating revenue, saving or earning foreign exchange, etc.)
- massive past capital investments in irrigation works but low productivity, poor economic returns on investment, shortfalls in area irrigated, inequity in water distribution, and waterlogging, salinity and flooding
- rising real costs of new projects as good sites become scarcer

The scale of the opportunity in India is indicated by the enormous area planned to be irrigable under existing major and medium projects. At the end of 1983-84, potential declared created is expected to be 30 million hectares with 25.4 million hectares utilised. The area which is effectively irrigated is, however, much less. Two very approximate estimates have been 11 million hectares in 1981 (Seckler 1981:8) and perhaps 13-14 million hectares in 1983 (Chambers 1983:2). Even if the figure were higher, there is no dispute about the enormous scope for improved performance.

Distractions from Better Management Now

Until recently, three approaches for improving performance have dominated thinking and practice:

rehabilitation through physical works on main systems

on-farm development (OFD), meaning development below the outlet of field channels, land levelling and so on

and 'educating the farmer'

A persuasive case can often be made out for the first two and vast sums have been and will be spent on them.

But all three approaches serve to divert attention from what irrigation system managers can themselves do immediately. At one level these three approaches can be seen as convenient reflexes, automatic responses determined and reinforced by professional training and experience and by the opportunity to place responsibility on others. Rehabilitation through physical works on main systems involves the design and construction in which civil engineers have been trained and which they find satisfying and rewarding. OFD on many major and medium canal irrigation systems in India 'passes the buck' from the Irrigation Department responsible for the main system to the Command Area Development Authorities (CADAs) responsible for development below the outlets. And 'educating the farmer' reflects the common tendency for urban-based, urban-biased highly trained professionals to blame the victim. This is easily done because it is on farmers' fields that mismanagement of water is most visible. It is much less visible, if seen at all, on the main system. Yet there is now a wealth of evidence that an adequate, timely, the predictable water supply delivered by canal managers to outlets is a precondition for good water management by farmers below them. Rehabilitation,, OFD, and educating the farmer are conveniently outside the immediate responsiblity of canal managers. As prescriptions, they have served, and continue to serve, to distract attention from the major opportunity which is within managers' control, namely management of the main system.

There are many ways in which main system management can be improved. Many of these do require, or would be made more effective by, new physical works such as additional cross regulators. The purpose of this paper, however is to indicate how performance can be improved either with no additional expenditure on construction, or with very low expenditure which may be feasible within existing budgets. Such improvements can be first steps in a sequence of gaining greater control of a system and manging it better and can be undertaken without delay. Later they can then lead to other steps which may include larger-scale physical rehabilitation and new facilities. The thrust of the argument is that there is no need to postpone action until rehabilitation has taken place. Ways can be sought to improve performance at once with what exists.

Rapid Appraisal and Analysis :[1] Do-It-Yourself

1. For a fuller exploration of rapid appraisal for improving existing canal irrigation systems see Chambers 1983 which also includes references to some of the relevent recent experience has been gained by the World Bank Team which has made rapid assessments of Dantiwada (Gujarat), Hirakud (Orissa), Nagarjunsagar (Andhra Pradesh) and Upper Krishna (Karnataka)

Irrigation systems have so many components and dimensions that appraisal and analysis can easily get lost in a mass of detail. There are very many alternative ways of improving performance. The focus here is on that subset which are within the control of the irrigation system manager, especially:

- scheduling and distribution of water
- communications (including monitoring)
- farmers' participation

These three, I shall argue, are major and challenging professional frontiers.

It is tempting to argue for large multi-disciplinary teams to conduct appraisals. The more the disciplines, it may be thought, the more likely it will be that all relevant aspects are covered. Unfortunately, more disciplines can also mean more delays and less likelihood of implementation. Moreover, disciplines like sociology and agricultural economics, though badly needed, have yet to provide the experienced, competent and committed cadre that is needed. Most irrigation system managers will for the time being have to be their own sociologists and agricultural economists. They may be able to collaborate with agricultural staff and to obtain other professional advice and support. But the need for unobtainable disciplines can be yet another excuse for delay. Managers can be their own multi-disciplinary teams and get on with doing the best they can.

With whatever assistance can be mustered locally, any irrigation system manager can conduct his own appraisal to identify how his system can be better managed. He can do this by using his professional knowledge and experience, though learning from the farmers who are his clients, and by applying intelligence, ingenuity and commonsense.

Before doing this, it will help for each manager to start by examining himself. He can try to see how his view of an irrigation system and of its problems and potentials are influenced by his experience and professional training, and then try to see what this view leaves out. No one can be perfectly multi-disciplinary but anyone can try.

Since almost all of those who are in charge of canal irrigation systems are civil engineers, often with long experience of operating systems 'top-down' from the headworks, it may help them to examine their mental image of the system, and then to make a heroic leap of imagination and try to see it from the other end, as a farmer does. The engineer sees the headworks and the water flowing away through canals towards distant farmers. The farmer's experience is opposite, from the bottom-up. He sees supplies of water which sometimes come and sometimes do not, from a series of channels stretching away up into the distance into zones beyond his control. Irrigation water may be to him like the weather, an important but unpredictable and risky part of the farming environment. Perhaps the most vital enterprise on the part of a civil engineer, as part of an appraisal, is to try to make this leap and see things the other way round, from the point of view of a farmer. He may then find the farmer with just the same sorts of needs as himself: The challenge then can be seen as finding ways to meet both sets of needs - those of the farmer and those of the manager - through better communications and better control of irrigation water flows; in short, through exploring the 'blind spot' of main system management which lies between the engineer managers and the farmer irrigators.

As a framework for appraisal, any short list of questions can be criticised. Irrigation systems are often so big, so complex, and so multi-dimensional that long lists can be compiled. Such long lists are useful as reminders (for a good example see Bottrall 1981). But short lists are needed for action, and necessarily involve judgements about what to leave out. The short list which follows is designed to help a manager quickly identify actions which can be taken without delay, with existing staff and resources.

The framework has four straightforward steps, each of which should be within the capacity of a manager without additional resources. Each can be phrased as a question:

1. How do farmers see your system? "Take hold of the other end of the stick". Make a deliberate effort to meet your clients on their ground, to learn from them, and to see the irrigation system from their point of view, as farmers, with crops. Start at the tail ends of the system, and move upwards. Have an open mind, and above all, listen and learn.

2. What are the objectives of managing your system? What should you be trying to achieve:

- generating incomes for small farmers and labourers through a reliable and adequate supply of water
- higher agricultural production
- equity, distributing water more fairly to more farmers
- environmental stability, avoiding waterlogging, flooding, erosion and the like,

and/or what else?

3. What is the current position?

What water resources are available?
How are they allocated and distributed? Where does the water go?
What hydraulic controls do you have?
What information reaches the farmers?
What information reaches you, the manager?

4. How, with what you have, could the objectives be better met?

What scope is there through improving:

scheduling
communication
farmer participation

More specifically, what scope is presented by six potentials:

	Mainly but not only by means of scheduling	communication	participation
1. rotations and reallocating water from head to tail	x		
2. saving irrigation water at night	x		
3. responses to rainfall	x	x	
4. better information for farmers about water supplies		x	x
5. better information and communications for managers about operations and performance		x	x
6. more farmer involvement in decisions and management		x	x

These will be examined in turn.

Six Potentials

i. rotations and reallocating water from head to tail

Liberal issues of water in the head reaches and scarcities in the tail are almost universal. Usually there is scope for throttling down on head reach issues through rotations and rationing and sending more water to the tails. This can apply to the management of a main or branch canal, of a distributary, or of a minor. Simple rotations, using existing control structures may often be a straightforward means of saving water.

The main problem is likely to be opposition from head reach farmers. They may, however, come to prefer a somewhat smaller total water supply if it is more reliably received. They may gain, not lose, from less water supplied predictably and appropriately, in the following ways:

- less flooding
- less waterlogging
- less washing out of fertiliser
- less leaching out of soil nutrients
- better water control at field level with more scope for crop diversification (especially growing crops that are more profitable than paddy)
- more timely operations
- (where water saved can be used later) an extra crop in the year

There is mounting evidence of the scope for redistributing in ways which mean that headenders as well as tailenders gain in the process. (For an early example, see Wickham and Valera 1979). This will especially be the case where a history of excessive water issues in the headreaches has led to waterlogging and flooding (see e.g. Joshi 1983).

ii. saving irrigation water at night

If night is taken as the period of darkness, and if darkness is taken as from 20 minutes after sunset to 20 minutes before dawn, then the hours of darkness (rounded to the nearest 10 minutes) in North India (Delhi) vary from 9 hours 20 minutes at midsummer to 13 hours at midwinter, and in South India (Madras) from 10 hours 30 minutes to 12 hours, with an all-season all-India average of about 11 hours 10 minutes or 47 per cent of the 24 hours.[1] Darkness is reduced when there is a good moon, but even then some of the difficulties and disincentives of night irrigation persist. It is difficult to

1. These figures have been calculated from GOI 1982.

estimate how much water is currently saved at night - through intermediate storage in tanks or canals, diversion to travelling, or closure of headworks, but it is probably quite a small proportion. A reasonable estimate may be that 40 per cent of the canal irrigation water on medium and major systems is either applied in night irrigation or sent into drains at night.

Night irrigation is often inefficient. Supervision is difficult and minimal. Neither engineers nor farmers willingly work at night. Night flows are often diverted to crops which tolerate flooding, mainly paddy, or are allowed to flow into drains. In Northwest India, where water is scarce compared to need, warabandi is practised at night (Malhotra 1982). But elsewhere warabandi at night is rare. It may be a reasonable estimate that outside NW India, over half the night flows, perhaps some 25 per cent of the total resource, is wasted at night and much of the 15 per cent which is applied at night is used inefficiently.

The potential for improvement through simple measures has been dramatically demonstrated on the Morna Project in Maharashtra (Joshi 1983). Flooding and waterlogging from irrigation were a problem. Night irrigation was not practised. Water was required to be stored for a summer crop. The management response was to see how water issues could be reduced at night. This was approached through a simple calculation. Water was assumed to be needed at the outlets only for 10 hours in the 24, from 0800 to 1800. Velocities of different discharges in the canal were measured. Transit losses were estimated. A schedule of discharges from headworks control were calculated so that water would arrive at different parts of the system during the 10 hours required, and night supplies would be reduced or eliminated.

A rotation schedule was prepared as a result of which flow days were more than halved, the hectare: Mcft ratio was raised from 1.02 (1978-79) to 1.40(1981-82), transit losses were reduced, and water was saved. Waterlogging, flooding and resulting insanitary conditions were largely eliminated.

The Morna Canal has a length of some 28 km, and average velocity was taken as 1.5 km per hour. On larger systems the calculations and options may be more complicated but on commonsense grounds there would appear to be scope for using controls and devising rotations so that more water is either stored or travelling at night, and less is passing through outlets. The opportunity is a good professional challenge to managers, who may find many different combinations of solutions.

iii. responses to rainfall

Response to rainfall appears a relatively neglected subject.[1]

The problems presented by rainfall receive more attention than the opportunities. Heavy rainfall, especially during kharif in north and central India, and during the Northeast monsoon in Tamil Nadu and neighbouring areas, can lead to serious flooding, with damage to crops, structures, and housing, and sometimes threatening human life. For canal management, the concern is then a negative one, to control water supplies, escapes and drains in such a way that damage from flooding is minimised.

The opportunities receive less attention. They are to with-hold and store water when rain falls or is expected. There is a distinction here between river diversion systems where there is no alternative use for the water not issued, and storage systems where water saved is a net addition to storage[2]. Even on river diversion systems, questions can be asked about alternative uses for canal flows when rain falls. If, for example, there is a deprived tailend (which is almost universal), prompt closure of branch canals and distributaries when rain falls at the head can release water to be sent to the tail; and if the canal is long, the water may arrive days later, well after the rain, when it can be used. On storage systems the case is clearer. Prompt and precise reaction to rainfall, or anticipation of it, may save water which can be used later to increase the area cropped, intensities, and yields.

Responses to rainfall are commonly on the basis of rules ofthumb, experience, and tradition. For any system, however, answers to the following questions may suggest improvements:

- what is the fortnightly[3] distribution of rainfall throughout the year?

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1. I should be grateful to any reader who can draw my attention to relevant writing, analysis and practices.

2. Water added to storage early in a rainy season is not a net addition if more than its equivalent spills later in the season and the spill water is not used elsewhere lower down. Probabilities of spilling are relevant here, and water may still be worth saving even if the probability of its being net is low. This will be the more so as water saved in low rainfall seasons tends to be more valuable.
3. Fortnightly is suggested by the nakshatras (varying from 11 to 17 days, with a modal length of 13) which have been shown in an elegant analysis to discriminate seasons and rainfall more usefully and naturally for agriculture in Bihar than either the English or the Bihari month (Chapman 1983)

- how does the intensity and frequency of rainfall vary
    - by season
    - by zone within the irrigation system?
- how is information about rainfall collected and communicated?
- what are current practices?
- could damage be reduced and/or water saved through improvements
    - in forecasting
    - in measurement and communication
    - in responses through water control
    - in special arrangements at key periods in the year?

iv. <u>better information for farmers about water supplies</u>

In rural development generally there is increasing emphasis on the importance of access to information. There are huge agricultural extension organisations which are meant to inform farmers about agricultural inputs, but less attention has been paid to informing farmers about the supply of their most crucial input, water. Any exercise of learning from farmers and seeing an irrigation system from their point of view is likely to show how critical for their farming decisions and for their livelihoods it is to know how much water they will receive and when it will come.

To be sure, on some big systems like Upper Ganga, schedules of rotations are published in advance of the season. In practice, however, changes have to be made in response to river flows, rainfall, and accidents. Complaints from farmers are common that they do not know what is happening or when water will come. In consequence they find timing their operations difficult; they tend to take as much water as they can whenever they can get it; and they go for low risk, low input strategies. Often <u>a more reliable supply of water, known about in advance</u> would <u>lead to</u> more widespread adoption of high-yielding practices than any conceivable amount of good advice from agricultural extension.

The canal irrigation manager can ask himself

- how far in advance are the water supplies to distributaries, minors and outlets known by him and his staff?

- how could they be known about earlier and more reliably?

- how could farmers be effectively and reliably informed (through handbills, notices on noticeboards, notices in newspapers, the public radio, meetings with staff) about water delivery schedules and changes?

v. better information and communications for managers about operation and performance

It is all too easy for the casual visitor and the critical analyst to point to poor performance on irrigation systems. But managers often face a serious lack of information. It is quite often observed that 'the managers simply do not know what is happening'. Water is flowing (or not flowing) over a vast area. How much is there at different points? What area is being irrigated, under what crops, at what stages of growth, with what water requirements? Where is the need for additional water greatest? These are questions which most irrigation managers, most of the time, cannot accurately answer. They do not have the information.

At one level, as stressed by Lenton (1983) and Seckler (1981), there is a problem of assessing performance of the irrigation system, and of indicators of productivity, equity and the like. These can be useful in comparing performance season by season and year by year, and are well worth developing.

At another immediate level, there is the question of information needed straight away for planning a season's water distribution and for day-to-day management. The best should not be the enemy of the good. Decisions have to be taken, or are taken by default, on inadequate, incomplete and inaccurate data. The data can, however, often be improved in accuracy, relevance and timeliness.

In the medium term there would appear a very high priority for radio communications. There is said to be no irrigation system in India with radio communications[1], although some canals are hundreds of miles long. But even without radios, much can still be done.

The irrigation manager can ask himself:

- what information is received at present, and how accurate, relevant and timely is it?
- what other priority information would directly help in management?
- with current resources, how could the information flows be made more adequate, accurate, relevant and timely?

1. Periyar Vaigai in Tamil Nadu is shortly to have radio communications installed as part of a World Bank-supported project.

vi. <u>more farmer involvement in decisions and management</u>

Farmer participation is a standard phrase in rural development but as so often the reality lags behind the rhetoric. Farmer participation on irrigation systems as elsewhere is liable to mean handing on to farmers all the more difficult and awkward tasks and expecting them to carry them out - maintaining channels, levelling fields, distributing water, and so on. There is also a built-in and tragic tendency for both irrigation officials and farmers to identify themselves as two teams playing a game against each other. In fact, farmers' organisations and participation can be strong allies and supports for any manager who wishes to improve the performance of his system.

Managers are subject to many pressures. These may be especially severe when an attempt is made to reduce supplies to head reach farmers in order to give more to the tails; when in the larger social interest water has to be denied to farmers who have planted crops illegally; and when rotations and improvements in distribution are being planned. At one level, the problems are political, and need 'political' solutions between the various interest groups of farmers themselves. If group interests are well represented, compromises and agreements can be negotiated and endorsed. This should make life easier for the manager who then has to implement a plan rather than take personal responsibility for working it out. His unpopular actions are based, then, not on personal decision but on group decisions.

On one major irrigation system, some headreach farmers had planted a crop to which they were not entitled. They approached a political leader for support for their claim for water out of season. This would have penalised other farmers lower down. The manager invited the political leader to make a recording of his request for the issue of water at the head end, so that this could be played to tailend farmers, but the political leader (prudently) declined. The manager then travelled throughout the system and told farmers about the problem. They in their turn then exercised their own political pressures, and successfully supported the manager's adherence to the decision not to issue extra water to the headenders.

Information and a sense of right are important here. The attempts to introduce warabandi outside Northwest India have had a somewhat chequered record. Distribution of water by precisely timed allocations below the outlet has probably been quite rare. But 'warabandi' has had the effect of generating among farmers a sense of right, a sense that they have a legitimate demand on the system. The noticeboards and measuring devices, even if not used as designed, have reinforced this sense of right.

This progress could be furthered by regular publication of performance data. Such data may not require special collection; they may already exist. On the Ghatampur Distributary of the Ramganga Project, for example, the Sinchpals of the Irrigation Department regularly report outlet by outlet the area actually receiving irrigation each season. This is recorded in a central register against the area designed to be irrigated. This shows, as might be expected, over-issues in the headreaches, and deprivation in the tail[1]. The publication of this information would cost very little. It would, however, serve to inform farmers and provide effective support for a manager who wished to achieve more equitable distribution.

The irrigation manager can, then ask himself:

- what greater part can farmers play in deciding and legitimating a plan of operation for water distribution?
- what information can be supplied to them about the performance of the system?
- what part can they play in decision-making at various levels of the irrigation system (below the outlet, at the minor level, at the distributary level, etc)?

1. Entries for two minors on the system can, for example, be analysed as follows:

		A headreach minor (Kisarwal) acres	actual receiving irrigation as % of designed	A tailend minor (Bairampur) acres	actual receiving irrigation as % of designed
Cultivable Command Area		1562		82	
Proposed for irrigation		626		28	
Actual receiving irrigation	1975	980	157	13	46
	1979	939	150	12	43
	1980	1039	166	Nil	0
	1981	926	148	Nil	0

Practical action by managers should usually be possible on some or all of these six potentials, or on other aspects of the three action domains of scheduling, communicating, and farmer participation. The three go together. Too much attention to one without the others can lead to trouble. A steady, step-wise, balanced and integrated development of all three is required.

The aim of this paper has not been to make full lists, but to select. It is vital not to start with too much complexity. There may be a temptation to wait for a multi-disciplinary team, for a large survey, for additional staff and funds, or for major rehabilitation or new works. Helpful though these might be, they might also sometimes hinder as well as delay the first steps. Gaining control and managing more can be begun without them, at once.

Nor should managers be inhibited by a sense that their methods will be imprecise. Simple is often sophisticated. Rough rules of thumb are efficient when data are poor and in the earlier stages of gaining greater control. In the seminal National Workshop in Scheduling of Irrigation held at the Water and Land Management Institute, Aurangabad, in November 1983 (WALMI 1983), there was a debate about the use of computers, including a vision of a future with 'a computer for every distributary'. The debate signalled the dangers of interventions getting out of line. The day for computers may come, but like other forms of hardware, they could once again provide an excuse for not starting action now. They also need good data which may not exist. The dramatic improvements on the Morna System reported by N.M. Joshi did not need a computer. Rather they involved simple measurement and heroic approximation. One was the averaging of the velocity of water in the canal to 1.50 km/hr., when volumes and velocities varied hour by hour and location by location, and when measured velocities ranged from 1.05 km/hr for 30 cusecs and 1.85 km/hr. for 120 cusecs. Or again, quite straightforward calculations were used in 1980/81 on a large distributary in Sri Ramasagar in Andhra Pradesh (D-86 with a design discharge of 766 cusecs) to identify rotations which would enable water to be pushed to the tails (Ali c. 1982). No doubt, on both Morna and Sri Ramasagar, with better data and a computer, greater precision in determining releases and rotations could have been achieved. But simple calculations and rules of thumb were for the immediate purpose sophisticated, because they could be used with good effect and without delay. At this stage, a quicker payoff can be sought from simple scheduling than cybernetics, from communications than computers, and from participation than rehabilitation. Those can follow; but they should not delay the start.

Practical Action

To encourage irrigation system managers to make their own rapid appraisals and introduce their own improvements through scheduling, communications and farmer participation, four measures readily suggest themselves:

1. the circulation to managers of relevant professional papers, especially papers by fellow managers describing their experiences (e.g. Joshi 1983, Lele and Chandorkar 1983).

ii. encouraging managers to write about the systems they operate and improvements they have introduced. Papers could be presented at a series of national and state-level workshops to share experience.

iii. preparation of a do-it-yourself manual, with case studies, on how to improve performance of a canal system without additional funds or staff.

iv. recognition of professional excellence through annual awards for the most outstanding achievements in improving system performance with existing resources.

These measures would support and accelerate the process. But even without them, progress can be made by managers on their own taking sensible, workable steps from where they are. Even without other rewards there is scope for immense professional satisfaction for today's irrigation system managers in improving performance with what they already have. There is no need for them to wait.

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